schemes. This subject is to have fuller treatment in the final Report of the Committee.

In addition to new allocations the Water Commission should have power to revise existing allocations, including the compensation water already prescribed by Act of Parliament. Another duty would be the setting-up of local Rivers Boards to control individual rivers as a whole.

One further safeguard is suggested, namely, the appointment by the Commission of an advisory committee, or committees, consisting of "representatives of water undertakings and scientific institutions, consulting engineers, and other qualified persons." Presumably the services of these specialists are to be solicited gratuitously. for the Commission "also" ask to be empowered "to obtain and pay for professional advice in connection with their investigations."

Perhaps one might be inclined to doubt whether the Committee has always kept clearly in mind the essential distinction between scientific and technical advice; but in one respect at least the Report will be welcome to scientifically minded people. It places in the forefront of the duties of the Water Commissioners the investigation by scientific study of the actual water resources of the country and the strengthening of existing agencies by the creation of a hydrometric survey of rivers. One cannot help regretting that the various survey bodies are not united under one scientific Department, for it would be a natural development if the Department of Scientific and Industrial Research were to add to the care of the Geological Survey that of the Ordnance Survey, the Meteorological Office, and the proposed Hydrometric Survey. In these matters, however, simplification comes slowly, and it is a great matter to find a clear statement of the truth, which is not self-evident to all our legislators, that one must first ascertain what our resources are before we proceed to distribute them.

We have endeavoured to state the conclusions as briefly and simply as possible, but the Report goes into much detail and requires careful reading. The system suggested is, we believe, as simple and efficient as it could be made, bearing in mind the initial determination to work so far as possible through existing agencies. But it is open to doubt the wisdom of that determination and to ask whether the creation of a Central Department dealing with all water questions, and with water questions only, might not, after all, be a simpler, cheaper, and more efficient solution of the problem.

The Mathematician as Anatomist.

Department of Applied Statistics, University of London, University College: Drapers' Company Research Memoirs. Biometric Series, x.: A Study of the Long Bones of the English Skeleton. By Karl Pearson and Julia Bell. Text: Part i., The Femur. Chaps. i. to vi. Pp. v+224. Atlas: Part i., The Femur. Pp. vii+plates lix+Tables of Measurements and Observations. (Cambridge: At the University Press, 1919.) Price, Text and Atlas, Part i., 30*s*. net.

Department of Applied Statistics, University of London, University College: Drapers' Company Research Memoirs. Biometric Series, xi.: A Study of the Long Bones of the English Skeleton. By Karl Pearson and Julia Bell. Text: Part i., Section ii., The Femur of Man, with special reference to other Primate Femora. Chaps. vii. to x., Appendices, Bibliography, and Indices. Pp. 225-539. Atlas: Part i., Section ii., The Femur of the Primates. Pp. vii+plates lx–ci+Tables of Femoral Measurements of the Primates. (Cambridge: At the University Press, 1919.) Price, Text and Atlas, Part i., Section ii., 40*s*. net.

If in the rapid increase of knowledge at the present time there is a tendency for men to limit their labours more and more to one narrow field of investigation, there is also, we are glad to note, an opposite tendency leading men who have become eminent in their own particular subject to cross professional frontiers and to carry war, seldom peace, into neighbouring or even distant specialities. In the present two great publications, devoted chiefly to the human thigh-bone, containing more than a quarter of a million words, with tables which give the results of at least 70,000 measurements, and illustrated by 105 anatomical plates, we find Prof. Karl Pearson, the mathematician, definitely settling himself in the front bench of speculative anatomists. He cannot have expected a warm welcome in his new quarters, for there are few British anatomists who do not bear the mark of at least one of those biometrical brickbats at the throwing of which Prof. Pearson has manifested very considerable skill. They did not hurt any the less because they were meant kindly! In spite of all their scars, however, British anatomists—nay, anatomists of every country—who study these volumes will forget their past sores and be glad to welcome him to their membership for the great service he has rendered to their subject, not only in this, but also in previous memoirs.

To understand aright what has been accomplished in the memoir now under review one has to go back twenty-five years to 1895, when Prof. Pearson, then the occupant of the chair of applied mathematics at University College, London, showed how the mathematical theory of statistics could and should be applied to all the manifestations of life. He was the only man then in England to perceive that Francis Galton was a really great man, and that if the knowledge relating to man and to living things was to be placed on a sound foundation, it must be laid by an application and an amplification of the Galtonian methods. Anatomists had made a survey of the human body and recorded their experience by giving accurate descriptions of what they had seen and broad generalisations as to what they thought. Prof. Pearson realised, as Galton had done before him, that no progress could be made in our knowledge of populations, races, or species until accurate standard methods of measurements had been applied to great numbers of individuals, and hence the first task which faced him, in building up a biometrical school, was the gathering of data to which statistical methods could be applied. Fortunately Sir George Thane, when professor of anatomy at University College, had had the foresight to store in his department great assemblages of human bones recovered from burial grounds in the East End of London—presumably remains of seventeenth-century Londoners who had died of the plague. This material became a treasure trove for the growing biometrical school.

Prof. Pearson's methods were applied to the skulls by the late Dr. W. R. Macdonald, and for the first time we had given to us standard data relating to the skull of the Englishman. Skulls have always been a favourite means for the study of racial characters, but Prof. Pearson wished to show that other bones had also their racial values, and by 1907 he was in a position, with the assistance of Miss Julia Bell, to commence his investigation of the thigh-bone.

Prof. Pearson had in the East London collection about 800 examples of this bone—each of which was examined, and in almost every instance measurements were made and estimates formed relating to eighty characters—in some examples to as many as a hundred—in order to establish the prevailing features of the thigh-bone of English men and women. He had to standardise old methods of making measurements and indices and to invent many new ones. In the course of his work he has brought to light many important facts which are new to anatomists. From this first phase of his investigation he was led, very naturally, to a second—to see how the English thigh-bone compared with that of Continental peoples. He had to search foreign records, and found them almost as barren of accurate details as those at home, but we cannot help noting his leniency towards the shortcomings of anatomists who live beyond the shores of England. Then followed in due course a third step—a comparison of the thigh-bone of the European with that of other races of the world—and a fourth—a comparison of the thigh-bone of modern man with that of ancient and extinct races of mankind. A fifth extension of his original aim was a comparison of the human femur with that of other members of the Primate class—the gorilla, the chimpanzee, the orang (the great anthropoids), the gibbon (or small anthropoid), the monkeys of the Old and of the New Worlds, and lastly with the lowest of Primate forms—the Lemuroids, including Tarsius. Then came a sixth extension—a study and comparison of the thigh-bones of extinct apes and Lemuroids. Finally, on the evidence he had thus accumulated from an intensive study of the thigh-bone, we have the construction of a pedigree or lineage of their owners—a pedigree which gives us the conception he has formed of man's evolutionary history and of man's relationship to the higher members of the animal kingdom.

By this natural sequence of inquiries the professor of mathematics has become an exponent of human phylogenetics. Setting out in 1907 with the intention of examining the femur of the Londoner, he ended in 1919 with a survey of the world of Primates.

Those who have had experience in arranging the members of a group of plants or animals—in conformity with their natural affinities—in a scheme which will express their evolutionary relationships are well aware that diverse, even contradictory, results are obtained, according to the system of parts used in framing the scheme of classification. If we arrange the Primates by grouping them according to the anatomical characters of their teeth, we get one result; if by their brains and nervous system, a second and very different grouping; if by their digestive system, a third; if by their reproductive system, a fourth, and so on. All the systems have to be taken into account, and to some, such as the brain, much more weight must be given than to others. In the most perfect scheme of classification there are always blemishes; the evidence of one system will be found to contradict or be at variance with that of another.

There need be no surprise at this variance of evidence; it should be so if heredity works in a Mendelian way. If we confine our attention, in framing a pedigree, to the parts of one system, more particularly to a single element of one system, as Prof. Pearson has done, there is a great risk of obtaining a purely artificial scheme of arrangement. If we use the thigh-bone alone, our classification of the Primates will serve to show only the evolution of their locomotory systems.

We are not forgetful that the discovery of a single fossil thigh-bone may be the sole basis on which we have to reconstruct an extinct form of man or ape. In such an event this memoir would be invaluable, for it gives us, for the first time, the basis on which a rational prophecy can be framed. There is a case in point which is very elaborately dealt with by Prof. Pearson—the thigh-bone of Pithecanthropus. He has applied more accurate and more elaborate tests to the anatomical characters of this bone than has hitherto been the case, and comes to the conclusion, as the majority of anatomists have already done, that in no essential point does it differ from that of modern man. And yet the skull assigned to this primitive humanoid form is almost as much that of an ape as of a man. Prof. Pearson is too cautious a man of science to deny the possibility of a being having at the same time an almost perfect human femur and a skull and brain which are non-human, but he is clearly more than sceptical, for in his scheme of classification Pithecanthropus must be given a place amongst races of modern man. Even when he has given us, as he has promised—and it is sincerely to be hoped he will be able to carry it out—his programme of research—the correlationship of the thigh-bone to all the other bones of the body and their correlationships to the jaws and cranium—there will still remain the infinitely more difficult task of stating in mathematical terms the correlationship of one system to another, such as that of the nervous to the digestive system, or of the respiratory to the reproductive, circulatory, and other systems. For some time, it is clear, we must depend, as in the past, on the somewhat crude methods of anatomical appreciation and analysis.

We have already told how the principal author of this monograph was led, during the latter part of the twelve years he devoted to a study of the femur, to ascertain what light his results shed on the evolutionary histories of mankind, the anthropoid apes, monkeys, and lemurs. It is true that his method of comparison sometimes leads him to quite surprising situations—of the humour of which he is perfectly aware—as when man and the pig find themselves the closest of allies as regards the diameters of their femoral shafts, or when the Old World monkeys find themselves cheek by jowl with man because of the equality of length in their femoral condyles. But on the whole his results and deductions must be regarded as helpful and trustworthy. It so happens that the writer of this review has, these thirty years past, been collecting data from all the systems of the Primate body (see Nature, 1911, vol. lxxxv., p. 508), and has from time to time assorted his observations to see how far a scheme of Primate evolution could be framed which would give a coherent explanation of the distribution of anatomical characters such as is now seen in the bodies of man, the anthropoid apes, and the monkeys of the Old and New Worlds. The results which have been reached by Prof. Pearson and the reviewer are, in the main, in harmony. The mathematical anatomist insists upon an anthropoid or troglodytic link in man's lineage; he claims to have reinstated the great anthropoid or troglodyte as a necessary stage in man's ancestry; but he will find that very few anatomists who have given this problem due thought have dismissed the anthropoid apes from the place given to them by Huxley. Prof. Pearson gives Tarsius a remote place in his scheme of human evolution. He is right, too, in dismissing the present-day gibbon from man's family tree, but altogether wrong if he supposes that the hylobatian stock from which the modern gibbon (highly specialised so far as limbs are concerned) arose plays no part in man's lineage. He is right, too, in concluding that the gibbon has no claim to be brigaded with the great anthropoids —the gorilla, chimpanzee, and orang. In their essential structure the gibbons form a separate group, one which serves to link together—or at least to bridge the gaps between—the monkeys of the Old and New Worlds and the great anthropoids. They are the essential link between monkeys and anthropoids. The femoral characters of the gibbon give a somewhat misleading indication of its true place in the phylum of the higher Primates.

As a common ancestor of the human and great anthropoid group—the pre-troglodyte in man's lineage—Prof. Pearson postulates a "Protsimio-human" Primate form, which he believes will turn out to be more human than anthropoid, a mathematical deduction with which few naturalists will agree. On the other hand, certain inferences made regarding the status and relationship of early races of man in Europe, founded entirely on the characters of their thigh-bones, are particularly worthy of attention. There has been much speculation regarding the existence of negroids in southern Europe in late Pleistocene times, founded on the discovery of remains of two Grimaldi individuals in a cave near Mentone. From a study of their skulls the reviewer came to the conclusion that they had nothing of the African negro in them, but that they were of the Cromagnon race, a conclusion which Prof. Pearson has reached independently from a study of their thigh-bones. He is uncertain of the relationship of Neanderthal and of Cromagnon man to modern races of mankind—uncertain as to whether these two types of ancient Europeans should figure as stages, or links, in the chain of modern man's evolution, or whether they really represent branches which have sprung from that stem. The evidence of their skulls and teeth leaves modern anatomists in little doubt as to their true relationships; Neanderthal man represents the terminal stage of a side branch, whereas Cromagnon man is but one of the numerous varieties of modern man. One other point is to be noted: in surveying the evolutionary evidence yielded by a single bone the same discordant array of indications is found as when all the systems of the body are studied; the final result has to be obtained by an exercise of judgment on the part of the classifier.

It is a matter of everyday observation that no two people walk exactly alike; there is the same infinite variety in the human gait as is found in the human face. Women have their own particular kind of progression; not one of us uses the right limb in exactly the same way as the left; the left foot is more frequently inturned to a greater degree than is the right. If, as medical men believe, bone-cells are peculiarly sensitive and responsive to the muscular and other stresses which are brought to bear on them, then there ought to be just that range of variation of form in the thigh-bone which this monograph demonstrates to exist. A functional explanation of the structural variation of the femur is one which Prof. Pearson is not prepared to entertain, and unfortunately medical men have as yet neglected, or almost neglected, the study of the living femur, and are therefore unable to say whether or not the anatomical forms of the femur are correlated to certain peculiarities of gait. The improvement in our means of examining the anatomy of the thigh-bone in the living by the aid of X-rays is likely to fill up this blank in our knowledge, and at the same time to offer a rational explanation of many puzzling features noted and estimated by Prof. Pearson and his collaborator. A study of the manner of progression of anthropoids in their natural habitats will help to show how closely form and function are correlated. In the orang, for instance, the hind limbs are reduced to mere grasping organs; in it and in the gibbon the swinging arms are the chief organs of progression. In the reviewer's opinion all measurements and calculations should be made, so far as is practicable, not only to indicate the degree and kind of racial characteristics, but also to express degrees and kinds of function. Indices should be of such a nature as to convey to the student a precise conception of the degree and kind of function.

This great memoir opens up a prospect which may well appal the heart of the stoutest anatomist. Here we have two parts, running to 539 pages, each page containing on an average more than 500 words, devoted to the subject which the authors speak of as femoralogy and the special students of which are called femoralogists, with the promise of a third part. When the examination of the human skeleton is completed on a corresponding scale we shall have an immense library. We may not like the prospect, but is there any option if our knowledge of mankind is to be based on a foundation which will last? The reviewer does not think there is any other way, and feels sure that the time will certainly come, if it has not already come, when anatomists the world over will acknowledge the courage, industry, and prescience of the English school of biometrics and of its founder. It would be a set-back to the progress of our knowledge of mankind were Prof. Pearson's projected programme to be in any way curtailed by a lack of financial assistance.

A. KEITH.

The Theoretic Basis of Psychotherapy.

The New Psychology and its Relation to Life. By A. G. Tansley. Pp. 283. (London: George Allen and Unwin, Ltd., 1920.) Price 10*s.* 6*d.* net.

ABOUT fifteen years ago Prof. Scripture, of Yale, published his book upon "The New Psychology." The psychology which was "new" then was experimental psychology; now the new psychology is something very different—the study of the non-rational processes of the human mind. Most of the material of Mr. Tansley's book consists in theories which are contained in the works of Prof. Freud, of Vienna; of Dr. Jung, of Zurich; and of Mr. William McDougall, who is just now leaving Oxford to settle at Harvard. The work of these three researchers has achieved world-wide renown; Mr. Tansley has done a good service in presenting some important elements of them in a compact and readable form. Mr. McDougall's books are accessible enough, but the views of the two Continental savants are scattered through various publications in a way which is rather baffling to the English reader. With